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Soilutions

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Crop Diagnostics – Beware the Pitfalls

Dee Ann Benard, Plant Pathologist

When a specialist goes into the field and diagnoses a problem, it often looks so easy. But beware: diagnosing most crop problems is more difficult than simply noticing one or two symptoms in a field. Knowledge of the crop and variety, field history, recent environmental conditions, pattern of the problem, etc. are necessary before even attempting a diagnosis. Looking for other, less obvious, symptoms is also important, particularly if the initially observed symptom(s) can be attributed to a number of potential causes. Knowing the symptoms associated with each of the possible causes can help the novice diagnostician know what else to look for when faced with a problem.

Wind damage can be used to illustrate some of the complexities of crop diagnostics. One of the symptoms of wind damage in barley is lodging. But lodging may have other causes, such as phosphorus, potassium or copper deficiency, excess nitrogen, eyespot (also known as strawbreaker), or even hail damage. It is important to know information such as the field history and the recent environmental conditions. Asking the right questions can help determine the cause of the problem. Questions to answer in this case include: " Do recent soil tests suggest a possible fertility problem?", "Has it been very windy?", "Has there been hail?", "Has the weather been cool and moist, which favours eyespot development?". Knowing the other symptoms associated with each possible cause can help the diagnostician know what else to look for: e.g., is there shattering? (associated with wind); does the lodging originate from points well above the ground? (associated with hail damage); do the culms have a charred appearance? (associated with eyespot); is there a purple pigment? (phosphorus deficiency); is there excessive tillering? (potassium deficiency); or is there lush growth? (excess nitrogen), or is the straw weak and the heads empty? (copper deficiency).

Accurate diagnosis is also important with problems that are easily confused with one another; the diagnostician especially does not want to confuse a harmless problem with a more serious one. For example, copper deficiency in barley may be confused with eyespot, take-all or root rots such as common root rot/seedling blight or browning root rot. Careful examination can help in their differentiation. While take-all is rare in Alberta barley, eyespot/ strawbreaker, copper deficiency and some of the root rots are fairly common. They can be quite damaging and control methods vary. Aside from knowing the various symptoms associated with each problem, sometimes there are simple diagnostic tests that can be performed in the field. For example, a diagnostic test to distinguish take-all from other root rots is to wash the roots and strip away the outer layers; in take-all, the central vascular cylinder will appear brown to black.

Once the cause of the problem is known, the diagnostician must know the economic impact. For example, a producer might notice some plants that don't look quite right. How does he or she know it's a problem? Fast and correct diagnosis followed by the appropriate action can sometimes mean the difference between a good crop and one that is unsalvageable. It

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Crop Diagnostics (cont'd)

can also mean the difference between unnecessary, expensive chemical application and the same crop quality and yield without chemical application. Sometimes, though the problem might be important, nothing can be done at the time. It's still important to correctly diagnose the problem, because it's not likely to go away on its own, and often preventive measures can be taken to avoid future losses. Let's examine the possible scenarios. In the first example, a potato grower notices a few patches of plants along the edge of a field that have water-soaked lesions on some of their leaves. The weather is cool and wet, with no change in sight. Should this grower be concerned? You bet!!! Those lesions herald a potential late blight epidemic, which, in a matter of days, could wipe out the entire crop. Immediate action needs to be taken: either contact fungicides need to be applied or, if the crop is mature enough, it should be top-killed. In the second example, a barley crop is infected with what appears to be net blotch. Net blotch is one of those diseases that is easily confused with other similar-looking but very different problems, so it is especially important to be careful with the diagnosis. There is a foliar fungicide that can be applied to economically control net blotch if the barley crop is of high value, so it's important that the diagnosis is correct. Conversely, if net blotch is diagnosed when the problem is actually something else, an expensive but useless application of fungicide could be made. Even if the crop isn't of high value (which would make fungicide application too costly), correct diagnosis is still important. Action can be taken to avoid future occurrences of net blotch, such as turning under all crop residue, growing alternative crops for at least two years, and planting only treated seed of resistant varieties.

One problem faced by many would-be diagnosticians is finding the information that can tell them what might be causing the symptoms they are seeing in the crop. Though there are many sources, such as publications, that describe crop problems in detail, they are generally organized by cause, so the diagnostician must already know what he or she is looking for. Reading this article, you will have noticed that most of the examples focus on barley. The Soil and Crop Diagnostic Centre and the Agronomy Unit are putting together a field diagnostic manual for barley, which contains information such as is found in this article, and is set up in such a way that, in most cases, a novice diagnostician should be able to determine the cause of a problem from the observable symptoms. This manual will help Alberta barley producers, crop specialists, and others working with the crop to diagnose problems in the field. For more information or to offer suggestions or comments, please contact:

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Karnal bunt in the U.S.

Ieuan Evans,
Plant Pathologist

The Karnal bunt problem grew worse, in March, when it turned up in durum wheat grown in Arizona. The discovery led to the immediate suspension of all foreign wheat shipments by the U.S., the world's biggest wheat exporter. As infestations turned up in wheat growing districts of Texas, New Mexico and California, some two dozen countries, including Canada, restricted or banned outright the purchase of U.S. wheat until the outbreak could be eradicated. That may prove a temporary advantage for prairie wheat growers, who stand to pick up markets the Americans lose. But it could also become a multimillion dollar headache for Canadian plant breeders. Much of the Canadian plant breeding industry counts on multiplication plots in the U.S. southwest, the area now under quarantine, to produce seed in the winter for planting here in the spring. All spring wheats, rye, triticale, oats and even barley grown in that area cannot be imported into Canada for spring planting this year.

Karnal bunt, named after a town in India, is a fungal disease that attacks wheat and triticale. It is primarily confined to Mexico and Asia. Karnal bunt turns the kernels of infected grain into a powdery soot that smells like rotting fish. A 1-2% bunt infection will result in rejection of wheat for food purposes. Karnal bunt is difficult to eradicate; its spores can lay dormant in fields for up to 5 years, and then spread on the wind or be carried to other fields by farm equipment. There are no fully effective chemical methods of controlling Karnal bunt.

Fertilizing Spring Wheat for Yield and Protein

Ross H. McKenzie and
Allan Middleton
Agronomy Unit, Lethbridge

A common question we were asked over the winter was "Is it economical to fertilize spring wheat with additional nitrogen to obtain a protein premium?" To answer this question, let's begin by reviewing the factors that affect protein in spring wheat. They include:

- soil nitrogen levels at the time of seeding
- the amount of nitrogen fertilizer applied prior to seeding or in-crop application
- soil moisture at the time of seeding
- time and amount of precipitation during the growing season, and
- temperature and heat (degree days) during the growing season.

Environmental conditions during the growing season play a very important role in influencing spring wheat protein content. If we knew what the weather would be like during the growing season of 1996, it would be possible to give a reasonably accurate answer.

With this in mind, lets look at a few scenarios to see how protein content varies under environmentally different conditions:

- When available soil N levels are low and there is no moisture stress, N rates up to 90 lb/ac will be used almost entirely to increase yield. At N rates greater than 90 lb/ac increases in protein may occur.
- Under intermediate moisture stress and low to moderate soil available N levels, the addition of nitrogen fertilizer will increase both yield and protein at the same time.
- Under prolonged moisture stress with moderate soil nitrogen levels, particularly later in the growing season, the addition of nitrogen fertilizer will mainly affect protein content but have limited if any influence on grain yield.

Lets now look at Table 1 (below) which has the yield increase for spring wheat in the Dark Brown soil zone, assuming that there is; 30 lb/ac of N in the soil, 4 inches of soil moisture at the time of seeding and, 7 inches of precipitation during the growing season. It is also assumed the nitrogen fertilizer is applied prior to or at the time of seeding. Table 1 has two prices for nitrogen fertilizer, 35¢ and 45¢/lb and assumes a spring wheat price of $4/bu. The economic analysis suggests that at 35¢/lb for N, that 40 lb of N/ac is economical, at a 2:1 return, from a grain yield standpoint. If N was 45¢/lb, the analysis suggests that 30 lb of N/ac is economical, at a 2:1 return.

To look further at the first scenario, at 35¢/1b for N fertilizer, it is economical to add 40 lb/ac of N fertilizer at a cost of $14 per acre. From our field research we think this would give approximately a 50 to 60% chance of having a protein content at about 13.5% and would produce about 37 bu/ac total and at $4/bu this would give a gross return of $148/ac.

However, if we assume that the premium for 14.5% protein wheat will be an additional 75¢/bu and if an additional 20 lb/ac of N were added, this could increase the probability to 75% of having wheat at 14.5%. The additional cost of the fertilizer would be $7 per acre and this would produce about 39.5 bu/ac at a value of $4.75/bu to give a gross return of $188/ac. **Therefore spending an extra $7/ac on nitrogen could return an additional $40/ac.**

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Table 1. Determination of economic nitrogen fertilizer response of spring wheat in the Dark Brown soil zone assuming stored soil moisture is 4 inches + pptn is 7 inches, when soil test nitrogen is 30 lb/ac (0-24 inch depth). Two nitrogen fertilizer costs of 35¢ an 45¢/lb are used. Fertilizer added is in lb/ac and yields are in bu/ac. The bold numbers indicate the point where marginal economic return is 2:1.

N Fertilizer Added	0	10	20	30	40	50	60	70	80	90	100
Expected Yield	25.4	29.6	32.7	35	36.8	38.3	39.5	40.5	40.5	40.5	40.5
Added Yield Increase/ 10 lb/ac N		4.2	3.1	2.3	1.8	1.5	1.2	1	0	0	0
1. Fertilizer Cost $0.35/lb Wheat @ $4.00/bu		3.50	3.50	3.50	**3.50**	3.50	3.50	3.50	3.50	3.50	3.50
		16.80	12.40	9.20	**7.20** 2.1	6.00	4.80	4.00	0	0	0
2. Fertilizer Cost $0.45/lb Wheat @ $4.00/bu		4.50	4.50	**4.50**	4.50	4.50	4.50	4.50	4.50	4.50	4.50
		16.80	12.40	**9.20** 2.1	7.20	6.00	4.80	4.00	0	0	0

Fertilizing Spring Wheat (cont'd)

When we look at the second scenario of 45¢/lb for N fertilizer, it is economical to add 30 lb/ac of N fertilizer at a cost of $13.50 per acre. This would give about a 50% chance of having a protein content at about 13.5% and would produce about 35 bu/ac, at $4/bu, for a gross return of $140/ac. If an additional 30 lb/ac of N were added at an additional cost of $13.50 per acre, this could increase the probability to 75% of having high protein wheat at 14.5%. This should produce about 39.5 bu/ac total at $4.75/bu, for a gross return of $188/ac. **Therefore, spending an extra $18/ac on N fertilizer could return an additional $48/ac.**

These two scenarios make it look promising to fertilize for protein rather than yield. Remember, the probability for reaching high protein is affected greatly by weather conditions.

Further, the premium paid for No. 1 spring wheat at 14.5% protein was about 80¢/bu in the last crop year. If the premium is only 20¢/bu in the next crop year, that would dramatically affect the economic picture.

Therefore, fertilizing for high protein wheat is a gamble and can be very risky. If you decide to try it this year, do it on a small scale, to keep your risk to a minimum!!!

Comparing Apples and Oranges

More Promulgations from a Plant Pathologist

I.R. Evans,
Plant Pathologist

When wheat, barley, oats, canola and other crops varieties are tested in Alberta, they are assessed on performance related to region, days to maturity and suitability for production under irrigation.

There is little correlation of performance with such factors as soil pH or micronutrient availability. We now know that cereals such as oats, wheat and barley are strongly influenced by soil pH. In Alberta we've got ranges from below 5 to well over 8. Some oat cultivars will perform best at lower pH's, others at pH's close to neutral. It stands to reason that if an oat variety was selected on high pH soils it would perform optimally in the pH range for which it was selected. The converse would be true for oat cultivars selected for low pH soils as is the usual custom in Europe where oats are regarded as the most tolerant of acid soil conditions.

Copper research in Alberta indicates that there are considerable differences between barley and oat varietal responses to soil copper availability. Some barley and oats varieties are relatively yield sensitive while others are very yield tolerant to low soil availability copper levels.

Is it possible that at some of our trial sites we may be measuring the copper response of these cultivars. In effect their response to copper may be the most important factor in determining actual yield differences.

It would then be prudent that when assessing varieties of any crop for yield performance we should ensure that the macro and micronutrient contents and pH of the soils, at each and every test site are at optimum or non limiting levels.

An interesting observation was made a few years ago when an accidental double dose of Avadex was applied to wheat trial plots involving eight varieties. Those wheat varieties developed before Avadex was on the market were severely set back by the double dose. Those "newer" wheats likely selected by plant breeders, using Avadex for weed control, were very tolerant of the double dose. Avadex used as a weed control chemical in a wheat variety trial could influence yield comparisons between these "older" and "newer" wheats.

Optimizing Barley Silage Production in Alberta

Ross McKenzie, Agronomy Unit, Lethbridge
Elston Solberg, Agronomy Unit, Edmonton

Approximately 750,000 to 800,000 acres of barley silage are produced annually in Alberta. Limited research has been conducted to determine which barley varieties have the best yield potential, agronomic characteristics and feed quality for silage production in the various soil and climatic areas of Alberta. The interactive effects of fertilizer and precipitation further complicate the problem for farmers attempting to select the best barley varieties and optimum fertilizer requirements for silage production.

A research project funded by the Alberta Barley Commission and the Alberta Agriculture Research Institute was started in 1994 to determine which barley varieties have the best yield potential and agronomic characteristics for silage production. The second objective is to determine the optimum economic fertilizer recommendations for barley silage production under irrigation in southern Alberta and dryland conditions in the Dark Brown, Thin Black, Black and Gray Wooded soil areas of Alberta.

The five barley varieties (Table 1) selected for study included Leduc, Tukwa, Seebe, AC Lacombe and CDC Earl. A sixth variety, Duke was included in the irrigated trials.

Each barley variety had pre-plant banded N treatments at 0, 40, 80, 120, 160 and 200 kg N ha^{-1}. A blanket application of seed- placed phosphate (P_2O_5) at a rate of 30 kg ha^{-1} was applied with all N treatments. Treatments of P, K and S were also included. All varieties were seeded to achieve a plant population of 250 plants m^{-2}.

Only the effects of nitrogen on yield and protein are discussed here.

Effects of Nitrogen Fertilizer on Yield

Nitrogen fertilizer response was dramatic at nine of the 11 research sites with yield increases up to 400% over control treatments.

For the irrigated sites at Bow Island, Lethbridge and Coaldale, AC Lacombe (Table 2) was among the highest yielding varieties. Seebe and Tukwa were also high yielding at Bow Island and Lethbridge. Lodging occurred at all three irrigated sites, with the worse lodging occurring at Bow Island.

At Barons and High River (Table 2), all varieties performed well except CDC Earl. At Pincher Creek, the three highest yielding varieties were Seebe, Tukwa and AC Lacombe. At Strathmore, Leduc was significantly higher yielding than the other varieties which were not significantly different from each other.

At Lacombe, Leduc, Tukwa and AC Lacombe were the highest yielding varieties. At Millet, Ellerslie and Barrhead, Seebe was consistently the highest yielding variety. In 1995, Tukwa and AC Lacombe also did reasonably well at these three central Alberta sites.

There was significant lodging at Barrhead and Lacombe sites. Considering the results of all the central Alberta sites, Seebe, AC Lacombe and Tukwa were frequently the higher yielding silage varieties.

Protein Content of Dry Matter

At the three irrigated sites, Bow Island, Coaldale and Lethbridge, CDC Earl consistently had the highest protein levels (Table 4). Duke also tended to have relatively high protein levels.

At Barons, Strathmore and High River, CDC Earl had the highest protein levels, followed by Seebe and Tukwa. At most of the southern sites, Leduc had the lowest protein levels. This same trend was also observed at the central Alberta sites (Table 5).

Closer examination of the protein data shows that when soil N levels were low, the addition of only 40 kg N ha^{-1} resulted in increased dry matter yield but caused a slight to very dramatic decline in protein levels. When a small amount of N is added, increased vegetative growth occurs, however the plants lack sufficient N for the entire growing period, resulting in lower protein levels.

Summary

The first and second year results of this study show there are significant differences among barley varieties in dry matter silage production. Nitrogen and phosphate fertilizer can dramatically increase silage yield potential when soil test levels of these nutrients are low.

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Table 1. Agronomic characteristics of barley varieties used in the project.

Variety	Row	Awn Type	Lodging Resistance	Scald	Net Blotch	Root Rot
AC Lacombe	6	Smooth	Very good	Intermediate	Intermediate	Susceptible
Leduc	6	Rough	Fair	Resistant	Intermediate	Intermediate
Seebe	2	Rough	Good	Resistant	Susceptible	Intermediate
CDC Earl*	6	Rough	Excellent	Resistant	Intermediate	Intermediate
Tukwa*	6	Smooth	Very good	Intermediate	Intermediate	Intermediate
Duke	6	Rough	Excellent	Intermediate	Susceptible	Intermediate

* semi-dwarf

There is often a profound interaction effect between nitrogen and variety on silage protein level.

This work will continue in 1996. At the completion of the field study, we will see which barley varieties have the best silage and protein yields under different environmental and management conditions. Nutrient response curves will be developed for making economical fertilizer recommendations and perhaps to predict protein yield potential.

The authors gratefully acknowledge funding for this project from the Alberta Barley Commission and the Alberta Agricultural Research Institute.

Ross McKenzie – South and South Central
Elston Solberg – Central

Table 2. Mean barley silage yield (kg/ha) of all fertilizer treatments at the southern Alberta sites in 1995.

Variety	Bow Island	Lethbridge	Coaldale	Barons	Pincher Creek	High River	Strathmore
Seebe	17554 a*	14897 a	14690 c	10615 a	7917 ab	12664 a	11860 b
Tukwa	16921 ab	14561 ab	14074 d	10390 a	8250 a	12695 a	11844 b
AC Lacombe	17230 a	14559 ab	17116 a	10188 a	7896 ab	12949 a	12243 b
CDC Earl	15871 c	14496 ab	14986 bc	9652 b	7510 bc	11634 b	11848 b
Leduc	17018 ab	13296 c	15512 b	10303 a	7325 c	12933 a	12843 a
Duke	16446 bc	13777 bc	14639 cd	–	–	–	–

* Yields followed by the same letter are not significantly different using Duncan's Multiple Range Test.

Table 3. Mean barley silage yield (kg/ha) of all fertilizer treatments at the central Alberta sites.

Variety	Lacombe	Millet	Ellerslie	Barrhead
Seebe	10721 bc*	10548 a	7399 a	8931 a
Tukwa	11706 ab	10423 ab	5430 c	8813 a
AC Lacombe	11642 ab	9620 b	6120 b	8048 b
CDC Earl	9682 c	8151 c	5372 c	7965 b
Leduc	12362 a	9543 b	5957 b	7788 b

* Yields followed by the same letter are not significantly different using Duncan's Multiple Range Test.

Table 4. Mean barley silage protein level (%) of all fertilizer treatments at the southern Alberta sites in 1995.

Variety	Bow Island	Lethbridge	Coaldale	Barons	Pincher Creek	High River	Strathmore
Seebe	9.96 cd	10.4 b	16.30 a	8.41 a	12.83 a	10.87 b	12.14 b
Tukwa	10.17 bc	10.6 b	16.19 a	7.92 b	11.94 bc	10.76 b	12.35 b
AC Lacombe	9.48 d	9.38 c	13.87 c	7.27 c	11.28 d	9.86 c	11.44 c
CDC Earl	10.85 a	11.49 a	15.80 ab	8.75 a	12.29 b	11.36 a	13.08 a
Leduc	8.67 e	9.22 c	12.97 d	7.01 c	11.73 cd	9.29 d	10.48 d
Duke	10.66 ab	11.39 a	15.21 b	–	–	–	–

* Yields followed by the same letter are not significantly different using Duncan's Multiple Range Test.

Table 5. Mean barley silage protein levels (%) of all fertilizer treatments at the central Alberta sites in 1995.

Variety	Lacombe	Millet	Ellerslie	Barrhead
Falcon	–	14.53 a	–	–
Seebe	12.37 b	11.28 cd	8.80 b	11.57 c
Tukwa	12.03 bc	11.64 c	9.86 a	12.39 b
AC Lacombe	11.46 c	10.38 e	8.70 b	11.26 c
CDC Earl	13.66 a	12.99 b	9.56 a	13.65 a
Leduc	10.59 d	10.89 de	8.72 b	10.55 d

* Yields followed by the same letter are not significantly different using Duncan's Multiple Range Test.

Time to Control Winter Annual Weeds

Linda Hall and Kim Stromme, Agronomy Unit

Direct seeders! Now is the time to look-out for winter annual weeds.

Winter annual weeds germinate in the fall, continue to grow after first frost and over-winter as seedlings or small rosettes. The following spring or early summer these plants flower and produce seed that is ready for fall germination. The rapid development of the flowering shoots (bolting) in the spring, gives winter annual weeds a competitive advantage over the crop.

In conventional tillage systems, winter annual weeds are controlled by tillage in spring or fall. In direct seeding systems, winter annuals can have the advantage because they are usually too mature to be controlled by an in-crop herbicide.

Winter Annuals

Usually Winter Annuals	Sometimes Winter Annuals
flixweed	bluebur
narrow-leaved hawk's-beard	white cockle
downy brome	common groundsel
common peppergrass	round-leaved mallow
shepherd's-purse	chickweed
stinkweed	stork's-bill
yellow whitlow-grass	cleavers
	scentless chamomile
	night-flowering catchfly

Winter annuals compete strongly with crops, using valuable nutrients and moisture. The best time to control winter annuals in a direct seeding system, is usually late fall from late September to mid or even late October. This is when the over-wintering stage is still young and the weeds are most susceptible to herbicides. Opportunities for fall control are often missed, because weeds are difficult to see at that time.

If winter annual weeds were not controlled in the fall, there is a second option. Winter annuals can be controlled with a spring herbicide application. Spring application can be as effective as a late fall application as long as the weeds are sprayed early. The best time for control is before the end of April. Once the weeds have bolted they are much more difficult and costly to control with herbicides.

Herbicide Options

These herbicide options are available for early spring control of most winter annual weeds.

- ✓ The key to control is identification of winter annual weeds, walk fields in spring and fall.
- ✓ Control winter annual weeds in **late** fall or **early** spring.
- ✓ Herbicide selection depends on: weeds present, herbicide costs and the following crop.

Herbicide	Before Seeding	Weeds Controlled
Roundup or Touchdown	Cereals Oilseeds Legumes	narrow-leaved hawks-beard (Roundup only), flixweed, downy brome, shepherd's-purse, stinkweed
Rus tler	Cereals (except oats)	flixweed, downy brome, stinkweed
Sencor	Cereals (except oats)	flixweed, downy brome, stinkweed, chickweed
Pardner	Cereals	stinkweed, bluebur, common groundsel, scentless chamomile, night-flowering catchfly

Please consult the1996 edition of *Crop Protection with Chemicals* (the bluebook).

Caring for Alberta's Air

West Central Airshed Society – Agricultural Biomonitoring Program

Rick Sherstabetoff – Tier II Environmental Services

The West Central Airshed Management Zone (WCAM) represents a shift from reacting to air quality issues to anticipating and addressing them, based on sound and scientific data. In west-central Alberta, environmental and health groups were already interested in finding a better way to monitor air quality. A multi-stake holder committee was formed to develop a zone management plan and the West Central Airshed Society was formed in March 1995. The society includes members from the public at large, transportation, oil and gas producers, gas transmission, forestry, agriculture, electric utilities, provincial government, and environmental non-government organizations. The purpose of the West Central Airshed Society is to:

- ✓ provide a forum to discuss and coordinate matters relating to managing and monitoring air quality in the zone;
- ✓ promote understanding of activities inside and outside the airshed, with respect to air quality within the airshed;
- ✓ identify and quantify air quality concerns based on credible data. Use this data to recommend and implement solutions; and
- ✓ coordinate and integrate airshed monitoring and develop management recommendations in the zone, according to provincial policies and guidelines as developed by the Clean Air Strategic Alliance.

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Caring for Alberta's Air (cont'd)

The West Central Airshed Management Zone covers the Drayton Valley, Edson, Hinton and Jasper areas to the B.C. border. The agricultural biomonitoring program covers the Breton and Alderflats area. Emissions in this airshed come from; oil and gas production, power production, gas transmission, forest products manufacturing, transportation, agriculture, general public (e.g. heating homes, cars), situated both within and outside the airshed. Several issues related to air quality were identified in this airshed: soil acidification, pollution stress on vegetation (crops and forests), human and livestock health, visibility and odor.

The monitoring program, which began in the spring of 1995, is at the heart of zone management. Air quality (levels of ozone, SO_2 and NO_x gases), is being monitored throughout the zone. In addition to traditional monitoring equipment, the program also uses bio-receptors. These bio-receptors are biological (plants) receptors of air quality effects. Biomonitoring will measure the effects of the air quality on plant growth and performance.

In 1995, six monitoring sites were established within the eastern portion of the WCAM Zone. Saskatoon and alfalfa (in rotation with barley) were used as the bio-receptors. Each monitoring area was divided into 4 subplots, which, at the end of a 4 year rotation will represent forage between 1 and 4 years old. An additional subplot was planted to saskatoons. Tier II Environmental Services Ltd. with the cooperation of Alberta Agriculture is one of the consultants working on the biomonitoring program.

As the data is gathered and interpreted, it will be shared with the public, other scientists, universities and government. It is the hope of the West Central Airshed Society that the data will be the basis for recommendations and will influence decisions made to benefit air quality within the zone.

For more information on the West Central Airshed Management Society, write:

West Central Airshed Society
P.O. Box 6360
Drayton Valley, Alta. T7A 1R8

For more information on the biomonitoring program, phone – Tier II Environmental Services at (403) 454-3642.

Fertilizing Peas in Alberta

Allan Middleton and Ross McKenzie, Agronomy Unit, Lethbridge

In 1994 the Agronomy Unit of Alberta Agriculture initiated a research study to examine yield response of peas to nitrogen, phosphate fertilizer and inoculant. Table 1 lists the 1995 sites and their managers.

CORE 1 plots studied response to nitrogen and were arranged with four varieties (Baroness, Carneval, Majoret and Radley), with and without inoculant, at four rates of nitrogen (0, 20, 40 and 60 kg/ha N). Most sites included a potassium and sulfur treatment. CORE 2 plots studied response to phosphate and were arranged with two placement methods (seedplaced and banded) at five rates of phosphate (0, 15, 30, 45 and 60 kg/ha P_2O_5).

CORE 1 *Southern Region* – Generally, Baroness and Majoret performed the best at most sites. Carneval also yielded well at most sites. Radley often yielded the lowest. Inoculation showed no clear trends due to a malfunction of equipment metering problems. Nitrogen fertilizer generally increased yields at most sites. This ranged from 0 to 40% yield increase over the check treatment.

South Central Region – Baroness and Majoret often ranked the highest in yield. Carneval also yielded well at most sites. Radley yielded lowest at all sites. Beiseker had a negative response to inoculant. Response to nitrogen was negative at Beiseker and positive at all the other sites (4 to 14% yield increase over check).

North Central and Peace River Regions – Generally, Carneval and Majoret yielded the highest. Baroness also yielded well at most sites. Radley yielded lowest at all sites. Most sites showed no response to inoculant. Lacombe had a negative response to inoculant. Nitrogen fertilizer increased yields from 0 to 13% over check treatment.

CORE 2 *Southern Region* – Phosphate increased yields in the range of 0 to 13%. There were no clear trends in relation to placement method. However, there was little if any injury to high rates of seed placed phosphate.

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Table 1. 1995 Dry Pea Production Sites and Managers

Southern Ross McKenzie	South-Central Norm Flore – Westco	North-Central Elston Solberg	Peace River
Barons	Beiseker	Barrhead	Beaverlodge – George Clayton, CDA,
Bow Island	Irricana	Ellerslie	Falher – SARDA
High River	Olds	Lacombe	Grimshaw – Dave Wong, AAFRD
Lethbridge	Red Deer	Vegreville	Wanham – Gary Coy, Canola Council
Pincher Creek		Viking	
Strathmore			

Fertilizing Peas (cont'd)

South Central Region – Data not available at time of writing.

North Central and Peace River Regions – There were no clear trends in relation to placement method, although seedplaced often yielded higher. Vegreville, Viking and Wanham showed no response to phosphate. The other sites showed a response that ranged from 8 to 19% increase over the check.

The 1995 results show that among the four varieties, Baroness, Carneval and Majoret yielded the highest. However, the highest yielding variety differed from site to site and region to region. In the majority of cases, inoculation did not increase yields over the uninoculated treatments. Nitrogen fertilizer often increased yields in the range of 5 to 10%, but was not clearly related to soil nitrogen levels. Phosphate placement showed no clear trend across all regions. Phosphate fertilizer often increased yields in the range of 5 to 20%.

This project will continue for another three years and hopefully a better picture will emerge as to when responses to nitrogen, phosphorus and inoculant occur.

The authors gratefully acknowledge funding for 1995 research from the Alberta Agriculture Research Institute, FFF On-Farm Demonstration Program, Alberta Pulse Growers Commission, Westco, Sherritt and Agrium.

Irrigated Bean Agronomic Research in Southern Alberta

R.H. McKenzie and K. Seward, R. Gaudiel and C. Wildschut, B. Lee

The dry bean industry ha rapidly expanded in the past 10 years in southern Alberta. More than 35,000 acres were grown in southern Alberta in 1995 with a farm gate value of over 17 million dollars.

Irrigation farmers like the option of growing a non-Canadian Wheat Board crop which frequently has a high cash value. They find that dry beans fit well into their overall farm management program. Beans are a nitrogen fixing crop that; increases residual nitrogen levels for subsequent crops, expands crop rotation options, and helps to break weed and disease cycles.

With the increasing interest in bean production, we developed a 3-year research project to look at improving the understanding of bean production in southern Alberta. This is the second year of the study. The three main objectives of the study are to:

1. Examine the responsiveness of commercial bean cultivars (Pinto, Red Mexican, Pink and Great Northern) to rhizobium bacteria (granular and liquid) and determine the need for nitrogen fertilizer.
2. Correlate bean cultivar response to phosphate fertilizer and to new P soil tests. A biological inoculant (Provide) is being examined to determine its effect on beans.
3. Determine the potential extent of zinc deficiency of beans to determine when responses will occur with each cultivar.

Three sites selected were at Bow Island, Taber and Coaldale.

In 1995, there was no yield response to either the granular or liquid inoculants at the three sites. This is similar to observations in 1994. There was significant response to nitrogen fertilizer at Bow Island to an additional 108 lb of N/ac and at Coaldale to 18 lb of N/ac, while there was no response to N fertilizer at Taber. All sites had less than 50 lb/ac of nitrate- nitrogen (NO_3-N) in the top 12 inches of soil. However, all sites had more than 100 lb/ac of NO_3-N in the top 36 inches of soil. In 1994, all three sites responded to added nitrogen fertilizer but there was limited response to the inoculants.

In 1995, there was no significant response to either phosphate fertilizer or to Provide at any of the three sites. Soil test P levels were 72 and 46 lb/ac in the 0-6 and 6-12 inch depths respectively at Bow Island, which is relatively high. Soil test P levels at Taber were 41 and 30 lb/ac in the 0-6 and 6-12 inch depths and at Coaldale were 38 and 9 lb/ac in the 0-6 and 6-12 inch depths. These are medium levels and some phosphate fertilizer response was anticipated. In 1994, sites at Vauxhall and Bow Island bean yields were increased with added phosphate, however, there was no response to Provide.

Both soil and foliar applied zinc treatments were examined on Pinto, Red Mexican, Pink and Great Northern beans as well as on Navy beans, which are the most sensitive to zinc deficiency. Bow Island and Coaldale had zinc levels of 1.5 ppm in the 0-6 inch depth while Taber had levels of 2.5 ppm. Presently, soil recommendations do not recommend Zn when soil test levels are higher than 1.0 ppm. The Bow Island and Coaldale sites did not respond to added zinc while beans at the Taber site significantly responded to both soil and foliar applied zinc. The fact that the Taber site was quite sandy may have played a role in the response

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Irrigated Bean (cont'd)

to zinc. The results have been somewhat different than anticipated and analysis of the data is continuing.

The authors gratefully acknowledge research funding from the Alberta Agricultural Research Institute, the Alberta Pulse Growers Commission, Westco, Agrium Biologicals, DowElanco and Philom Bios.

Please feel free to contact us if you would like to discuss the project.

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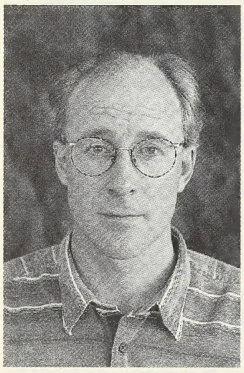
Meet the Specialist

Danial John Heaney, Program Leader, Agronomy Unit



Born and raised in Edmonton, I'm a city kid who got interested in agriculture while helping the farmer next to our summer cabin put up hay and shovel grain. I graduated from U of A with a B.Sc. in Agronomy in 1980. Originally I had ambitions of becoming a crop breeder but a couple of summers working for Pioneer Hi-Bred in their Kansas based wheat program cured me of that notion.

I completed an M.Sc. in Soil Science in 1985 with Marv Nyborg looking at overwinter cycling of nitrogen. In 1984, I joined the staff of the U of A, Soil Science Department as the Laboratory Coordinator. My career with Alberta Agriculture started in 1989 when I joined the Agriculture Soils and Animal Nutrition Laboratory. I joined the Agronomy Unit in 1995 and promptly left to go back to school. This will be my first field season with the unit and I'm looking forward to the challenge of getting back into a field based research program.

Working out of the lab let me get involved with a variety of research projects generally dealing with soil and plant tissue testing as it relates to crop production and soil quality. A few of these included:

- Field evaluation of lab tests for soil phosphorus
- Nutrient management of irrigated alfalfa
- Soil, water and forage quality of saline seeps
- Optimal seedplaced fertilizer with airseeded crops
- Site specific farming systems
- Modelling phosphorus reactions using and agro-ecosystem approach.

More recently, I have been focussing on fertilizer reactions in the soil as part of my doctoral work at the U of A. What I have found particularly interesting in this work is the way urea solubilizes soil organic matter and increases the soil solution levels of most of the other macro and micro-nutrients. Interesting as it is, I plan to get school behind me very soon. The next few years should find me directing my research efforts toward understanding soil variability and how it interacts with management, environment, pests and crops. As the program leader, it's also my job to make sure Agronomy Unit is headed in the right direction. That's the direction you, our clients, want us to go. So if you have thoughts and ideas on what needs to be done, please give me a call.

"Don't Leave it to Cleavers"

Cleavers Awareness Campaign

Alberta, Saskatchewan and Manitoba are working together to create an awareness and understanding of cleavers, a weed that is a growing concern in Western Canada.

Cleavers can be recognized by its long climbing sticky stems. It is usually an annual weed, but may also grow as a winter annual. The seeds are the primary problem because they are difficult to separate from canola seeds. Contamination of canola seed by cleavers often results in crop rejection at the elevator or downgrading and reduced profitability. The twining stems often cause crop lodging. The tangled mess gets caught up in equipment causing harvest difficulties.

All Extension Specialists in Alberta should have recently received a "Cleavers Resource Binder", containing detailed up-to-date information about cleavers and how to manage its spread. The objective of this campaign, is to extend this information to all growers in areas where cleavers is, or could become a problem. The campaign will continue throughout April and May, encouraging growers to scout for cleavers.

A new "Cleavers Factsheet" is available for distribution in each province. In Alberta, the Factsheet (Agdex #642-2) is available at AAFRD, Publications Branch, Edmonton 427-0391.

Please contact your local Crop Specialist or Agricultural Fieldman with questions or concerns regarding cleavers.

Kim Stromme, AAFRD, Agronomy Unit

Dear Aggie,

What practices can be used to ensure that nitrogen is available later in the growing season – to increase % protein in wheat?

Sincerely,
Highper Cent

Dear Highper,

The timing of nitrogen availability plays a key role in the resulting % protein in grain.

The main sources of nitrogen in use are urea, ammonium nitrate and anhydrous ammonia. None of these sources are considered to be "slow release". Anhydrous ammonia must be applied preplant while urea and ammonium nitrate can be applied pre or postplant. All sources are susceptible to loss due to volatilization, denitrification or leaching.

To maximize efficient use of most sources of nitrogen fertilizer, it is best to apply them as close to seeding as possible. Therefore, to enhance protein levels by having nitrogen available later in the growing season, it may be necessary to use split applications. Nitrogen which is applied up to the 5 leaf stage is utilized by the plant to increase yield. The response from nitrogen fertilization during the tillering and jointing stages is mainly yield, but there will be some increase in protein levels. As the plant matures, response to application of nitrogen fertilizer will shift from yield response, to protein production.

If reliance on the initial application of fertilizer for yield and protein production is necessary, many factors come into play. The availability of nitrogen, and loss of nitrogen due to volatilization, denitrification and leaching, is very dependent on: rainfall, soil and air temperature, soil moisture, soil texture, soil aeration, C to N ratio in the soil, nitrogen source, timing of N application, method of application, etc.

Nitrogen fertilizer should be applied at rates high enough so that yield is not reduced and there is enough available nitrogen in the soil for the plant to use for protein production as it reaches maturity. A balance must be struck when applying high levels of nitrogen to optimize yield and protein but avoid lodging, which is detrimental to yield and protein production.

One way to help ensure that fertilizer is available later in the growing season is to **reduce losses**.

- **Fertilizer placement:** Fertilizer which is broadcast on the surface of the soil can be very susceptible to loss due to volatilization. Losses can be quite high under the right environmental conditions. Deeper placement of fertilizer can reduce loss. When fertilizer is placed at lower depths, the soil moisture is likely to be greater and therefore root growth is enhanced, increasing nutrient uptake. This also places the nitrogen below the rooting zone of weeds with shallow root systems. This gives the crop a competitive advantage and reduces the loss of fertilizer being used by weeds.
- **Denitrification and leaching:** These losses are very dependent on environmental conditions and can vary greatly depending on timing and amount of rainfall received.

In the future, slow release fertilizers may give producers more control over the timing of nitrogen availability. This may make increasing the percent protein in wheat more easily and economically achievable.

Dear Aggie,

Is virulent blackleg under control? How do I reduce my risk?

Sincerely,
Lept MacUlans

Dear Lept,

Virulent blackleg is an extremely destructive disease of canola. If uncontrolled, this fungal disease can reduce a potential disease susceptible canola crop of 35 bu/ac to less than 7 bu/ac. Localized spread from field to field is by fungal spores from infected canola. Long distance spread of this fungus can only take place via infected canola seed.

In 1995, the Peace River region had 62 fields of confirmed virulent blackleg out of 2057 fields surveyed. Most of those crops were in the Birch Hills and Smoky River municipalities. In the rest of Alberta, 804 crops were surveyed and 76 crops were confirmed with virulent blackleg. Most of these were in the Counties of Wheatland, Beaver, Vermilion River and Minburn; the M.D. of Minburn and the S.A. of Consort. In several areas in central Alberta, Bullet, a moderately tolerant Argentine variety, was confirmed with virulent blackleg. In one instance, it was obvious that the infected plants were volunteer Westar in the Bullet crop. Most infestation levels were relatively low except in those fields planted to continuous Westar.

If you are able to grow Argentine canola, there is now a wide range of blackleg tolerant to resistant varieties to choose from. The very susceptible (5 rating) varieties, Westar and Alto, have been replaced by varieties with ratings of 2 and 3 and new varieties such as Quantum with a 1 rating (i.e. highly tolerant or resistant). Unfortunately one of our better Argentine varieties and all of the Polish varieties have ratings of 4. This means that they are highly susceptible to blackleg and as a consequence could suffer heavy yield losses if blackleg is present and you grow canola after canola. For all Polish varieties and Argentine varieties with 4 ratings, it is still sound policy to follow a 3 to 4 year crop rotation.

You can write to:
Dear Aggie, c/o **Soilutions**
Alberta Agriculture, Food and Rural Development
905, 6909 - 116 Street,
Edmonton, AB., T6H 4P2

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